What is Claimed:

1. An ultrafast nonlinear all-optical switch having a switching speed of less than 1 picosecond for light with a wavelength of about 1.55 micrometers, the switch comprising:

(a) a substrate; and

(b) a material disposed on the substrate, the material including a plurality of carbon nanotubes and a polymer forming a composite.

2. The material according to claim 1 wherein the material is a third-order nonlinear optical material.

3. The material according to claim 1 wherein the material is substantially transparent.

4. The material according to claim 1 wherein the polymer is polyimide.

5. The material according to claim 1 wherein the nanotube loading is less than about 0.1 wt %.

6. A nonlinear optical material comprising a plurality of carbon nanotubes and a polymer forming a composite.

7. The material according to claim 6 wherein the material is a third-order nonlinear optical material.

8. The material according to claim 6 wherein the material is substantially transparent.

9. The material according to claim 6 wherein the polymer is polyimide.

10. A nonlinear optical article comprising:

(a) a substrate; and

(b) the material of claim 6 disposed on the substrate.

11. The nonlinear optical article according to claim 10 wherein the article is an ultrafast all-optical switch.

12. The ultrafast all-optical switch according to claim 11 wherein the switch has a switching speed of less than 1 picosecond for light with a wavelength of about 1.55 micrometers.

13. A process for preparing a nonlinear optical switch comprising:

(a) preparing a plurality of carbon nanotubes;

(b) suspending the nanotubes in a solvent;

(c) sonicating the nanotube-and-solvent suspension, yielding a suspension with substantially uniformly distributed nanotubes;

(d) separately dissolving a polymer resin in the solvent, yielding a polymer solution;

(e) mixing the nanotube-and-solvent suspension and the polymer solution, yielding a uniform distribution of nanotubes in polymer solution;

(f) baking the nanotube-polymer solution to remove most of the solvent;

(g) curing the polymer resin;

(h) baking the nanotube-polymer composite to remove any retained solvent and to form a nonlinear optical nanotube-polymer composite material; and

(i) depositing the material on a substrate.

14. The process according to claim 13 wherein the step of depositing the material on the substrate is accomplished using lithography techniques.

15. The process according to claim 13 wherein the carbon nanotubes are purified before they are suspended in the solvent.

16. The process according to claim 13 wherein the concentration of the carbon nanotubes is tuned to achieve predetermined properties in the material.

17. The process according to claim 13 wherein the polymer is polyimide.

18. The process according to claim 13 wherein the step of preparing the nanotubes includes applying the HiPCO method.

19. The process according to claim 13 wherein the solvent is γ-butyrolacetone.

20. An ultrafast all-optical nonlinear switch comprising:

(a) a substrate; and

(b) a material disposed on the substrate, the material including a plurality of carbon nanotubes incorporated into a silica.